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Interim Report
February 2005



**OPEN RADIO COMMUNICATIONS
ARCHITECTURE CORE FRAMEWORK V1.1.0
VOLUME 3 SOFTWARE REQUIREMENT
SPECIFICATION**

L-3 Communications Government Services, Incorporated

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STINFO FINAL REPORT

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| 12a. DISTRIBUTION / AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED. | | | | 12b. DISTRIBUTION CODE |
| 13. ABSTRACT (Maximum 200 Words) This document describes the software requirements of a Joint Tactical Radio System (JTRS) Software Communications Architecture (SCA) implementation called the Core Framework (CF). This Software Requirements Specification (SRS) defines the requirements for the Open Radio Communications Architecture Core Framework (OrcaCF) v1.1.0 in accordance with the JTRS SCA version 2.2. The CF software package contains: an Operating System per SCA v2.2, Section 3.1.1, Middleware and Services per SCA v2.2, Section 3.1.2, a Core Framework per SCA v2.2, Section 3.1.3, and a simple application per SCA v2.2, Section 3.2. The OrcaCF was developed on a standard Intel x86-based PC running the Linux Operating System (OS) from RED HAT. The Object Request Broker (ORB) is The ACE ORB (TAO) from Doug Schmidt's web site. The OrcaCF includes the Xerces XML parser from Apache. | | | | |
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1.0 SCOPE

The government (henceforth referred to as “AFRL”) requires a Joint Tactical Radio System (JTRS) Software Communications Architecture (SCA) implementation called the Core Framework (CF), for research and rapid prototyping of SCA compliant software waveforms. This document describes the software requirements of a CF.

1.1 Identification

This Software Requirements Specification (SRS) defines the requirements for the Open Radio Communications Architecture Core Framework (OrcaCF) v1.1.0 in accordance with the JTRS SCA version 2.2. The OrcaCF was developed for the Air Force Research Laboratory (AFRL).

1.2 System Overview

This SRS addresses the software requirements for the OrcaCF Project. The developer shall develop, integrate, and test the components to deliver a functional CF that is in compliance with the SCA v2.2. The CF software package shall contain:

- An Operating System per SCA v2.2, Section 3.1.1
- Middleware and Services per SCA v2.2, Section 3.1.2
- A Core Framework per SCA v2.2, Section 3.1.3
- A simple application per SCA v2.2, Section 3.2

and meet Logical Device and General Software Rule requirements of SCA v2.2, Sections 3.3 and 3.4, respectively. Figure 1-1 shows conceptually how the OrcaCF software components fit together.

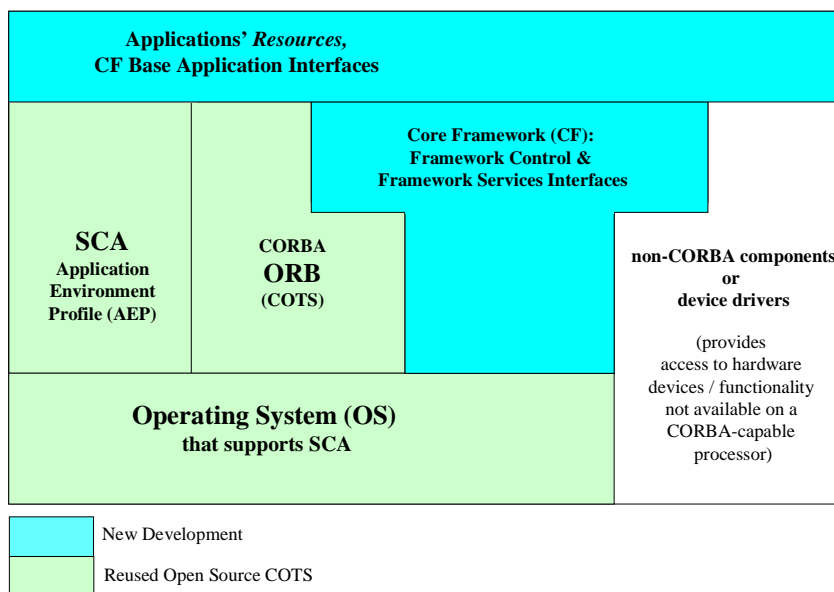


Figure 1-1. OrcaCF Concept

The blue highlighted areas will be new software development, as described in this SRS. The OrcaCF will be developed on a standard Intel x86-based PC running the Linux Operating System (OS) from RED HAT. The Object Request Broker (ORB) is The ACE ORB (TAO) from Doug Schmidt's web site (reference 2.2.b). The OrcaCF includes the Xerces XML parser from Apache. User manuals and training will be provided, which allow users to competently operate the CF.

1.3 Document Overview

This document is a SRS for the OrcaCF product. This SRS identifies applicable requirements for OrcaCF software development.

This SRS is structured in sections following the format and content provisions of the SRS Template with minor tailoring.

Section 2.0 lists all documents referenced by this SRS and used during its preparation.

Section 3.0 identifies the software requirements.

Section 4.0 describes the qualification provisions.

Section 5.0 lists the requirements traceability.

Section 6.0 contains notes and acronyms.

Section 7.0 lists the appendices.

1.3.1 Relationship to Other Plans

This SRS makes reference to other JTeL Software Products, which are described in their own separate documents. The following documents that affect this development:

- JTRS Test Application (JTAP)
- Waveform Test Tool (WTT)

1.3.2 Order of Precedence

In the event of conflict between the requirements of this document and other applicable standards or requirements documents, the applicable standards take precedence.

1.3.3 Licenses, Copyrights and Trademarks

The software is licensed under the GNU Lesser General Public License (LGPL). Please refer to the disclaimer on the title page of this document, and Appendix A of the OrcaCF Software Users Manual (SUM) for complete license, copyright, and trademark information.

2.0 REFERENCED DOCUMENTS

2.1 Government Documents

Standards and other publications produced by government agencies that have been utilized in creating this document are listed here.

- a. Software Communication Architecture (SCA) Specification with Appendices, MSRC-5000SCA V2.2, 17 November 2001
- b. Application Program Interface (API) Supplement to the Software Communications Architecture Specification with Appendices, MSRC-5000API V1.1, 17 November 2001
- c. Security Supplement to the Software Communications Architecture Specification with Appendices, MSRC-5000API V1.1, 17 November 2001
- d. Support and Rationale Document (SRD) for the Software Communication Architecture Specification, V1.2, 21 December 2000
- e. JTeL SCA Requirements Matrix, Export+V1+--+Load+v1+--+SCA+Baseline+ReqmtsV1.1.xls, 8 Aug 2002
- f. Data Item Description DI-IPSC-81433A, Software Requirement Specification, December 1999.
- g. Aeronix JTRS Test Application (JTAP) and documentation, v2.3.1 July 2003

2.2 Non-Government Documents

Same as previous subsection, but the documents were not published by government agencies.

- a. RED HAT Linux website: <http://www.redhat.com>
- b. Fedora website: <http://fedora.redhat.com/>
- c. ACE/TAO websites: <http://www.cs.wustl.edu/~schmidt/TAO.html>, <http://www.theaceorb.com/>
- d. OCI TAO Developers Guide version 1.2a, volume 1&2 (Part numbers 510-01, 510-02), Object Computing Inc., 2002; available from
- e. Software Engineering Institute Capability Maturity Model for Software, Version 1.1, February 1993
- f. Industry Implementation of International Standard ISO/IEC 12207: 1995, Standard for Information Technology, Software Life Cycle Processes, IEEE/EIA 12207 Series, March 1998

3.0 REQUIREMENTS

This section specifies the OrcaCF Computer Software Configuration Item (CSCI) requirements. The requirements for the OrcaCF are derived from the SCA v2.2. Each requirement shall be assigned a project-unique identifier to support testing and traceability and shall be stated in such a way that an objective test can be defined for it. The degree of detail to be provided shall be guided by the following rule: include those characteristics of the CSCI that are conditions for CSCI acceptance; defer to design descriptions for those characteristics that are implementation decisions left to the developer. For example, the OrcaCF requirement to support CORBA services shall be stated in this document; however, the selection of an ORB to provide CORBA services is a design decision that shall be documented in the Software Design Description (SDD).

At this time, the SRS only identifies the applicable requirements of the SCA version 2.2, as listed in the SCA Requirements Matrix in section 7.1, Appendix A. The SCA requirements have been peer reviewed by the JTeL and form the core set of requirements for the OrcaCF project. The SCA requirements will be introduced in the following paragraphs, and the reader is referred to the Requirements Matrix for the complete list of the SCA requirements.

- **Definitions**

Shall: When used in this specification, the word “shall” refers to an explicit requirement of a system component or the complete system.

Should: When used in this specification, the word “should” refers to a desired characteristic of a system component or the complete system.

Will: When used in this specification, the word “will” provides information for a characteristic of a related system component or a complete related system.

3.1 Required States and Modes

SCA paragraph 3.1.2.4.2.1, and subparagraphs, describe the states of the Core Framework:

| States | Modes |
|----------------------|---------------------------------|
| ADMINISTRATIVE_STATE | LOCKED, UNLOCKED, SHUTTING_DOWN |
| OPERATIONAL_STATE | ENABLED, DISABLED |
| USAGE_STATE | IDLE, ACTIVE, BUSY |

Table 3-1. SCA Core Framework States and Modes

3.2 Core Framework CSCI Capability Requirements

As stated in SCA Paragraph 2.2.1.4, the CF is the essential (“core”) set of open application-layer interfaces and services to provide an abstraction of the underlying software and hardware layers for Waveform software application designers.

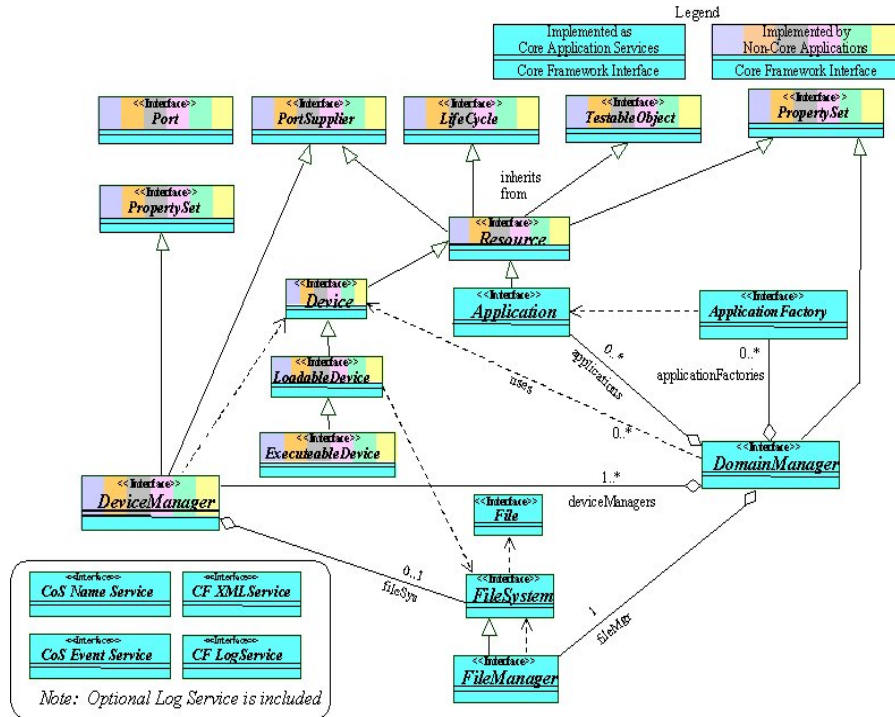


Figure 3-1. Mapping of Core Framework Capabilities to OrcaCF

The OrcaCF consists of:

1. Base Application Interfaces (*Port*, *LifeCycle*, *TestableObject*, *PropertySet*, *PortSupplier*, and *Resource*) that can be used by all software applications,
2. Framework Control Interfaces (*Application*, *ApplicationFactory*, *DomainManager*, *Device*, *LoadableDevice*, *ExecutableDevice*, and *DeviceManager*) that provide control of the system,
3. Framework Services Interfaces that support both core and non-core applications (*File*, *FileSystem*, and *FileManager*)
4. The XML Domain Profile (not shown in Figure 3-1) that describes the properties of hardware devices (Device Profile) and software components (Software Profile) in the system,
5. SCA Services (CosNaming, CosEvent and LogService).

The Domain Profile supports the combination of resources to create applications. Device Profile and Software Profile files utilize an XML vocabulary to describe specific characteristics of either software or device components with regard to their interfaces, functional capabilities, logical location, inter-dependencies, and other pertinent parameters.

3.2.1 Base Application Interfaces

Port, *LifeCycle*, *TestableObject*, *PropertySet*, *PortSupplier*, and *Resource* shall be provided for use by all software applications.

3.2.2 Framework Control Interfaces

Application, *ApplicationFactory*, *DomainManager*, *Device*, *LoadableDevice*, *ExecutableDevice*, and *DeviceManager* shall provide control of the system.

3.2.3 Framework Services Interfaces

The OrcaCF shall support both core and non-core applications (*File, FileSystem, and FileManager*).

3.2.4 Domain Profile

Describes the properties of hardware devices (Device Profile) and software components (Software Profile) in the system.

The Domain Profile supports the combination of resources to create applications. Device Profile and Software Profile files utilize an XML vocabulary to describe specific characteristics of either software or device components with regard to their interfaces, functional capabilities, logical location, inter-dependencies, and other pertinent parameters.

3.2.5 SCA Services

The OrcaCF shall provide CosNaming Service, CosEvent Service, and Log Service.

3.3 CSCI External Interface Requirements

Figure 3-2 shows the Core Framework interfaces from Section 3 of the SCA specification. The Core Framework can use any Operating System calls. The OrcaCF uses standard CORBA to support portability.

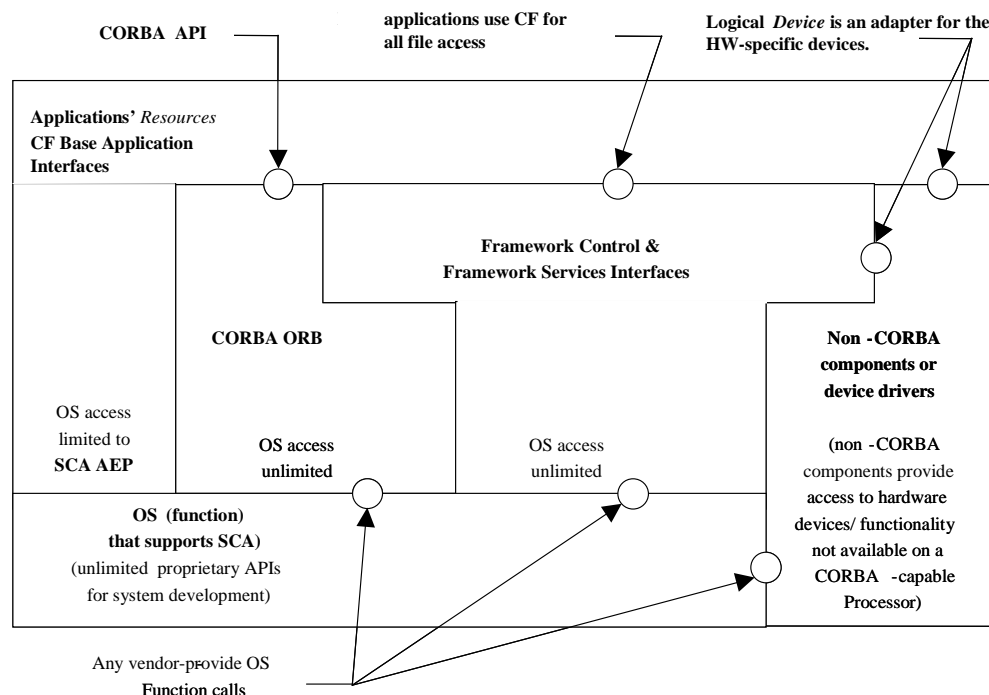


Figure 3-2. Core Framework Interfaces

3.3.1 Interface Identification and Diagrams

There are no additional interface requirements other than those specified in the SCA and shown in Figure 3-2.

3.4 CSCI Internal Interface Requirements

Within the CF CSCI, standard CORBA interfaces shall be used, as specified in the SCA and listed in APPENDIX A. SCA Requirements Matrix.

3.5 CSCI Internal Data Requirements

The OrcaCF shall support the XML formats as described in the SCA Appendix D and Attachments 1 and 2 to Appendix D.

3.6 Adaptation Requirements

The OrcaCF v1.1.0 shall provide a Software Users Manual (SUM) that describes how to install, configure, operate, and uninstall the OrcaCF.

3.7 Safety Requirements

There are no Safety requirements for the OrcaCF.

3.8 Security and Privacy Requirements

There are no Security requirements for the OrcaCF.

3.9 CSCI Environment Requirements

The following minimum operational environment requirements are needed to run the OrcaCF:

- CPU – Intel® Pentium® III 550MHz
- RAM – 512MB SDRAM
- Display – ATI RAGE 128
- Sound – SoundBlaster PCI 128, or equivalent
- Storage – 10GB IDE hard drive with ext3 filesystem
- NIC - 3Com 3C590/3C595/3C90x, or equivalent

3.10 Computer Resource Requirements

There are no Hardware Resource requirements for the OrcaCF.

3.10.1 Computer Hardware Requirements

The OrcaCF shall be designed to run on a Pentium PC, or equivalent.

3.10.2 Computer Hardware Resource Utilization Requirements

There are no Hardware Resource Utilization requirements for the OrcaCF.

3.10.3 Computer Software Requirements

The following requirements shall be incorporated into the CSCI:

- The OrcaCF shall use an XML Parser.
- The OrcaCF shall provide CORBA ORB Services as part of the CF.
- The OrcaCF shall provide a Naming Service as part of the CF.
- The OrcaCF shall provide Event Services as part of the CF.

3.10.4 Computer Communications Requirements

The following computer communications requirements shall be used by the CSCI:

- The Pentium PC shall have an Ethernet Network Interface Card (NIC).
- The Pentium PC shall have an audio soundcard (or equivalent) to support stereo audio.

3.11 Software Quality Factors

- The OrcaCF shall be designed in accordance with SCA paragraph 3.4 General Software Rules.
- The OrcaCF shall be designed in accordance with Capability Maturity Model (CMM) Level 3 best practices and Object Oriented Design Techniques.

3.12 Design and Implementation Constraints

- The CF shall provide an architecture document that describes the high-level design of the CF including the functionality and interaction between the major software components.
- The CF shall maintain a SRS that identifies the implementation SCA requirements and articulates the interfaces between the major software components of the CF in accordance with the JTeL Requirements Management Plan (RMP).
- The CF shall be built in accordance with the JTeL Software Development Plan (SDP) as adapted in the CF SDP Annex.
- The CF shall be designed to incorporate future enhancements to the SCA and its supplements as necessary.
- The OrcaCF shall use ANSI C++ to maximize portability to a Windows 2000 environment.

3.13 Personnel-Related Requirements

There are no Personnel-Related requirements.

3.14 Training-Related Requirements

The OrcaCF Team shall provide a Software User Manual (SUM) that describes how to install, configure, operate, and uninstall the OrcaCF.

3.15 Logistics-Related Requirements

There are no Logistics requirements for the OrcaCF.

3.16 Other Requirements

There are no additional requirements for the OrcaCF.

3.17 Packaging Requirements

There are no Packaging requirements for the OrcaCF.

3.18 Precedence and Criticality of Requirements

There is no Precedence or Criticality of requirements for the OrcaCF.

4.0 QUALIFICATION PROVISIONS

This section shall define a set of qualification methods used to ensure that each requirement has been met. Qualification methods may include:

- a. Demonstration: The operation of the CSCI, or a part of the CSCI, that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis.
- b. Test: The operation of the CSCI, or a part of the CSCI, using instrumentation or other special test equipment to collect data for later analysis.
- c. Analysis: The processing of accumulated data obtained from other qualification methods. Examples are reduction, interpretation, or extrapolation of test results.
- d. Inspection: The visual examination of CSCI code, documentation, etc.
- e. Special qualification methods: Any special qualification methods for the CSCI, such as special tools, techniques, procedures, facilities, and acceptance limits.

The qualification process is shown in Figure 4-1. The OrcaCF will be developed in multiple builds. Prior to the release of each version, the OrcaCF team shall perform inspection, analysis, demonstration, and testing of the OrcaCF using the JTRS Test Application (JTAP) tool. The JTeL Product Working Group will perform the independent validation and verification through peer review (analysis/inspection) and JTAP testing. Each build will be reviewed and evaluated by members of the JTeL team. Any defects or bugs will be recorded and sent back to the OrcaCF Team for resolution. Bug fixes shall be incorporated into the next build, as needed.

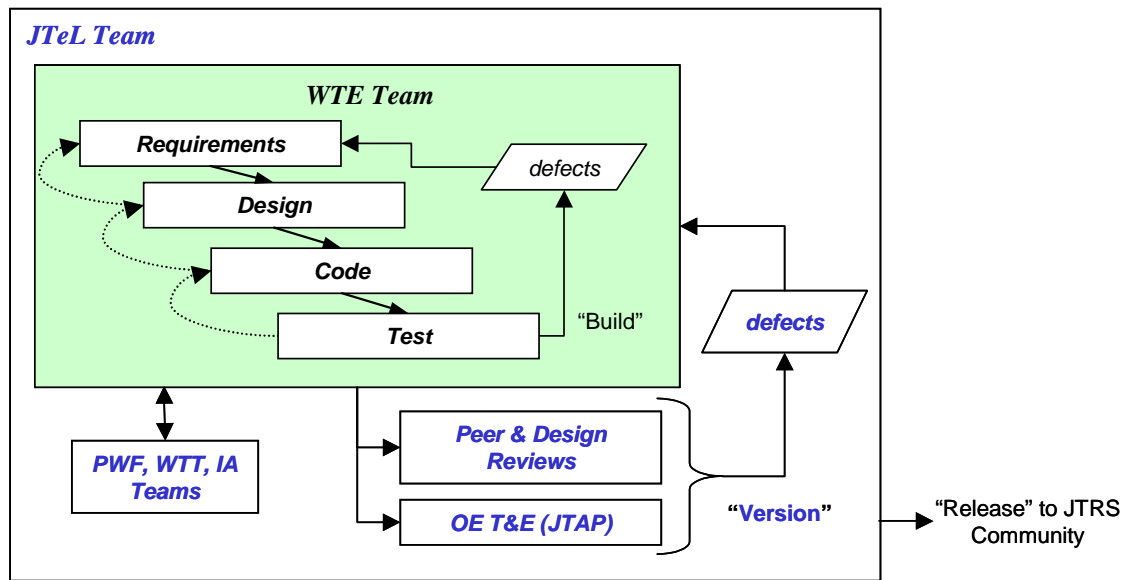


Figure 4-1. JTeL Qualification Process

5.0 REQUIREMENTS TRACEABILITY

At this time, the SRS identifies traceability to the SCA version 2.2, as listed in Appendix A SCA Requirements Matrix. These SCA requirements have been peer reviewed and form the core set of requirements for the OrcaCF project.

6.0 NOTES

6.1 Abbreviations and Acronyms

| | |
|----------|---|
| A | |
| AFRL | Air Force Research Laboratory |
| API | Application Program Interface |
| B | |
| bps | Bits per Second |
| C | |
| CDRL | Contract Data Requirements List |
| CD-ROM | Compact Disk- Read Only Memory |
| CF | Core Framework |
| CI | Configuration Item |
| CM | Configuration Management |
| CMM | Capability Maturity Model |
| CORBA | Common Object Request Broker Architecture standardized by OMG |
| COTS | Commercial Off-the-Shelf |
| CP | Change Proposal |
| CSCI | Computer Software Configuration Item |
| D | |
| DID | Data Item Description |
| DoD | Department of Department |
| DSP | Digital Signal Processor |
| DTD | Document Type Description |
| E | |
| ECP | Engineering Change Proposal |
| EMI | Electromagnetic Interference |
| F | |
| FQT | Formal Qualification Test |
| FY | Fiscal Year (Military October to September) |
| G | |
| GHz | Giga Hertz (One Billion Cycles per second) |
| GP | General Purpose |
| GUI | Graphical User Interface |
| H | |
| HCI | Human-Computer Interface |
| HMI | Human-Machine Interface |
| HW | Hardware |
| HWCI | Hardware Configuration Item |
| I | |
| IA | Information Assurance |
| IDD | Interface Design Description |
| IDL | Interface Definition Language standardized by OMG |
| IEEE | Institute of Electronics and Electrical Engineers |
| ILS | Integrated Logistics Support |
| INFOSEC | INFormation SECurity |
| IOC | Initial Operational Capability |
| IP | Internet Protocol |
| IRS | Interface Requirements Specification |

| | |
|----------|--|
| IV&V | Independent Verification and Validation |
| J | |
| JPO | Joint Program Office |
| JTAP | JTRS Test Application |
| JTeL | JTRS Technology Laboratory |
| JTRS | Joint Tactical Radio System |
| K | |
| KPA | Key Process Area |
| L | |
| LAN | Local Area Network |
| LCCB | Local Configuration Control Board |
| LCM | Life Cycle Maintenance |
| LOS | Line Of Sight |
| M | |
| MNS | Mission Needs Statement |
| MSC | Message Sequence Chart |
| N | |
| NB | Narrow Band |
| NSA | National Security Agency |
| O | |
| OCD | Operational Concept Description |
| OE | Operating Environment |
| OMG | Object Management Group |
| OOD | Object-Oriented Design |
| ORB | Object Request Broker |
| ORD | Operational Requirements Document |
| OS | Operating System |
| OT&E | Operational Test & Evaluation |
| P | |
| PC | Personal Computer |
| PDR | Preliminary Design Review |
| POSIX | Portable Operating System Interface for UNIX |
| Q | |
| QA | Quality Assurance |
| R | |
| RF | Radio Frequency |
| RM | Requirements Management |
| RMP | Requirements Management Plan |
| RTOS | Real-Time Operating System |
| S | |
| SCA | Software Communications Architecture |
| SCCB | System Configuration Control Board |
| SCM | Software Configuration Management |
| SCMP | Software Configuration Management Plan |
| SDD | Software Design Description |
| SDP | Software Development Plan |
| SEI | Software Engineering Institute |
| SLOC | Source Lines of Code |
| SOW | Statement of Work |
| SPP | Software Project Plan |

| | |
|----------|---|
| SPS | Software Product Specification |
| SQT | System Qualification Test |
| SRS | Software Requirements Specification |
| SSC-SD | SPAWAR Systems Center San Diego |
| SSDD | System/Subsystem Design Description |
| SSS | System/Subsystem Specification |
| STD | Software Test Description |
| STP | Software Test Plan |
| SU | Software Unit |
| SUM | Software User Manual |
| SVD | Software Version Description |
| SW | Software |
| T | |
| TECHEVAL | Technical Evaluation |
| TR | Test Review |
| U | |
| UHF | Ultra High Frequency |
| UML | Universal Modeling Language standardized by OMG |
| V | |
| VHF | Very High Frequency |
| VME | VERSA Module Eurocard |
| W | |
| WBS | Work Breakdown Structure |
| WF | Waveform |
| WTE | Waveform Test Environment |
| WTT | Waveform Test Tool |
| WWW | World Wide Web |
| X | |
| XML | eXtensible Markup Language |

7.0 APPENDICES

7.1 Software Requirements Matrix

The JTeL Requirements Working Group generated a numbered list of testable SCA requirements in Appendix A. This requirements list has been tailored to identify those that apply to the OrcaCF project.